

## **REMARKS**

The present Amendment is in response to the Examiner's Office Action mailed July 27, 2006. Claims 19, 32, and 34 are cancelled, claims 1, 8, 10, 16, and 23, 31, and 33–36 are amended, and new claim 37 is added. Claims 1–18, 20–31, 33, and 35–37 are now pending in view of the above amendments.

Reconsideration of the application is respectfully requested in view of the above amendments to the claims and the following remarks. For the Examiner's convenience and reference, Applicant's remarks are presented in the order in which the corresponding issues were raised in the Office Action.

Please note that the following remarks are not intended to be an exhaustive enumeration of the distinctions between any cited references and the claimed invention. Rather, the distinctions identified and discussed below are presented solely by way of example to illustrate some of the differences between the claimed invention and the cited references. In addition, Applicants request that the Examiner carefully review any references discussed below to ensure that Applicants' understanding and discussion of the references, if any, is consistent with the Examiner's understanding.

### **I. PRIOR ART REJECTIONS**

#### **A. Rejection Under 35 U.S.C. §102(e)**

The Examiner rejects claims 8–12 and 16–30 under 35 U.S.C. § 102(e) as being anticipated by *Kinoshita* (United States Patent No. 6,535,537). Because *Kinoshita* does not teach or suggest each and every element of the claims as amended, Applicants respectfully traverse this rejection in view of the following remarks.

*Kinoshita* teaches a vertical cavity surface emitting laser that has two mirrors sandwiching an active region. The top mirror is made from a plurality of layers, some of which are partially oxidized. As mentioned in the office action, Figure 5B of *Kinoshita* illustrates the laser and its oxidized layers. Figure 5B is reproduced below.

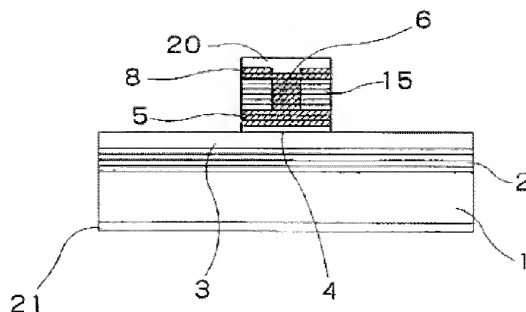


Figure 5B

Figure 5B illustrates a DBR mirror 6 situated on an active region 4. Oxidation layers 15 of DBR mirror 6 are oxidized. (See col. 1, lines 25–51.) However, *Kinoshita* emphasizes that the oxidized layers 15 do not extend through the entire layer (*i.e.*, layers 15 are partially oxidized). This feature is clearly evident from the hash marks that show that the oxidized layers 15 are not oxidized in the center of the mirror. Furthermore, *Kinoshita* states:

Each selective oxidation layer 15 acts as an insulating body, which means that no current will flow in the active layer 4 if the selective oxidation should happen to extend throughout the entire cylindrical mesa 10. The progress of the selective oxidation must therefore be halted at an optimal distance from the side walls of the cylindrical mesa 10. Col. 1, lines 48–53 (emphasis added).

Consequently *Kinoshita* makes it clear that the oxidation layers 15 are not and cannot be fully oxidized, rather the oxidation layers 15 are only partially oxidized to leave an aperture in DBR 6.

In direct contrast, independent claims 8, 16, and 23 have been amended to require a “fully” oxidized layer in the mirror (*i.e.*, no aperture in the oxidation layer(s) of the mirror). In particular, claim 8 requires “a fully oxidized layer” in the first mirror, claim 16 requires that “every other layer of said first stack of layers is fully oxidized”, and claim 23 requires “fully oxidizing a plurality of layers of the first stack of layers.” Support for these amendments can be found in the Application at pages 4 and 12.

In claims 8, 16, and 23, the fully oxidized layers are included in the first mirror to give the mirror a desired reflectivity. A fully oxidized layer provides oxidized material in the vertical center of the laser, which is in the direct path of the light being emitted by stimulated emission. Thus a fully oxidized layer provides reflectivity in the vertical center where the reflective properties are most advantageous. In contrast, a partially oxidized layer, like layer 15 shown in

Figure 5B of *Kinoshita*, creates an aperture along the vertical center and therefore lacks the desired reflective properties in the vertical center of the mirror. Therefore, Applicant's respectfully request that the rejection of claims 8, 16, and 23 over *Kinoshita* be withdrawn.

**B. Rejection Under 35 U.S.C. §102(b)**

The Examiner rejects claims 8–13 and 16–22 under 35 U.S.C. § 102(b) as being anticipated by *Jewel* (United States Patent No. 5,881,085). In response, Applicant has amended claim 8 to require the first mirror to include “a non-oxidized AlGaInAs layer” and an oxidized layer comprising “InGaAsP, InAlAs, InAlGaAs, AlAsSb, AlGaAsSb, AlGaPSb or AlPSb.” Support for this amendment can be found on page 11 of the Application. *Jewel* teaches a non-oxidized layer of InP or GaInAs paired with an oxidized layer in a bottom mirror. However, *Jewel* does not teach or suggest using a non-oxidized layer of AlGaInAs paired with an oxidized layer. These particular oxidized and non-oxidized materials are at least in part responsible for the novel properties and configuration of the mirror of the claimed laser. Consequently, Applicant's respectfully request that the rejection for anticipation by *Jewel* be withdrawn.

Claim 16 has also been amended to require particular combinations of non-oxidized and oxidized materials in a lower mirror. In particular, claim 16 has been amended to require oxidized layers that include “an oxide of InAlGaAs, AlGaAsSb, AlGaPSb, or AlPSb.” Support for this amendment can be found on page 11 of the Application. The *Jewel* reference does not teach the use of “oxidized InAlGaAs, AlGaAsSb, AlGaPSb, or AlPSb” in combination with a non-oxidized layer of InP. Therefore, Applicant's respectfully request that the rejection of claim 16 over *Jewel* be withdrawn.

**C. Rejection Under 35 U.S.C. § 103**

The Examiner rejects claims 1–7 and 14–15 under 35 U.S.C. § 103 as being unpatentable over *Jewel* (U.S. Patent No. 5,881,085). As stated in the Office Action, it is the Examiner's position that “[i]t would have been obvious to the one having ordinary skill in the art at the time the invention was made to provide the aluminum content about 52% so that the [] oxidized layers can be lattice matched with the InP substrate to prevent cracking or dislocation when manufacturing the device.” Office Action at p. 7.

Applicants traverse the Examiner's rejection for obviousness on the grounds that one of skill in the art would not be motivated to make such a modification. Firstly, the *Jewel* reference is directed to manufacturing an aperture in a top mirror. As far as applicant's are aware, there is no teaching in *Jewel* as to the aluminum content of the bottom mirror disclosed in *Jewel*. Furthermore, *Jewel* teaches an aluminum content of 98% in the oxidized layer. See col. 9, line 64. One of skill in the art would not be motivated to modify the mirror of *Jewel*, which teaches 98% aluminum, to arrive at the claimed aluminum content of about 52%. The *Jewel* reference teaches that for oxidized materials, the selection of the aluminum content is significant. *Jewel* states, "The oxidation rate of materials such as AlGaAs is a *sensitive function* of the Al concentration ...". col. 2, lines 22–23 (emphasis added). *Jewel* also states, "It has been found [] that the precise composition of a pre-oxidized layer may have a *profound effect on the reliability* of the oxidized structure." col. 2, lines 27–30 (emphasis added).

In light of these teachings in *Jewel*, Applicant's submit that one of skill in the art would not be motivated to modify the aluminum content disclosed in *Jewel* to arrive at the claimed invention. Therefore, Applicant's respectfully request that the rejection of claim 1 under §103 be withdrawn.

Claims 31 and 33–34, have been rejected as obvious in view of *Jewel* (US Patent No. 5724374) referred to as *Jewel* '374 patent. Claim 31 has been amended to remove the limitation requiring "less than 60% aluminum." Therefore the obviousness of modifying *Jewel* '374 in this manner is now moot.

Claim 31 has been amended to require a lower mirror with "about 6 pairs of layers" having a "non-oxidized layer comprising InP or AlGaInAs," and an oxidized layer that comprises "oxidized InGaAsP, InAlAs, InAlGaAs, AlAsSb, AlGaAsSb, AlGaPSb or AlPSb." Applicant's submit that none of the references of record alone or in combination teach or suggest a laser having a lower mirror with only about 6 pairs of layers and including the particular combinations of oxidized and non-oxidized material. Mirrors with only about 6 pairs of layers can advantageously be used where the mirrors are made of the foregoing materials. Application p. 4. Claim 31 as amended is believed to be allowable over the art of record. Thus, Applicant's respectfully request that the rejection for claim 31 be withdrawn.

With regard to the remaining claims, new claim 37 has been added. Claim 37 depends from claim 23 and recites a step of providing additional trenches for oxidizing layers of the lower mirror. Support for this amendment can be found in Figure 4 of the Application and its accompanying text.

Amendments were also made to claims 10, 33, and 34–36. Claim 10 has been amended to clarify what structure provides the wavelength of energy emitted. Claim 33 has been amended so as to have proper antecedent basis in light of the amendments made to claim 31. Claims 35 and 36 depend from claims 1 and 8, respectively. Claims 35 and 36 have been amended to limit the number of pairs of layers in the mirror. Support for this amendment can be found on page 4 of the Application.

Claims 2–7, 9–15, 17–18, 20–22, 24–30, 33, and 35–37 are dependent claims that depend from one of claims 1, 8, 16, 23, or 31. Therefore, claims 2–7, 9–15, 17–18, 20–22, 24–30, 33, and 35–37 are allowable for at least the reasons that claims 1, 8, 16, 23, and 31 are allowable.

**CONCLUSION**

In view of the foregoing, Applicants believe the claims as amended are in allowable form. In the event that the Examiner finds remaining impediment to a prompt allowance of this application that may be clarified through a telephone interview, or which may be overcome by an Examiner's Amendment, the Examiner is requested to contact the undersigned attorney.

Dated this 27<sup>th</sup> day of December, 2006.

Respectfully submitted,

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